

# Determinants of livelihood choice and implications for targeted poverty reduction policies: A case study in the YNL river region, Tibetan Plateau

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## ARTICLE INFO

### Keywords:

Livelihood choice  
Poverty reduction  
Livelihood asset  
Climate change  
The YNL river region

## ABSTRACT

Governmental policies that can develop advantageous endogenous livelihood transition are of great importance for anti-poverty. However, the existing research finds that in the Tibetan Plateau, there is a certain contradiction between the poverty alleviation policies and the local farmers' needs, and thus the effect of these policies will be weakened and the goal of poverty alleviation be missed. It is therefore imperative to identify and analyze the factors influencing the livelihood choice so that policy makers and development practitioners can design policies that will tackle the poverty afflicting the majority of the local people. This paper provides a new method for anti-poverty policymaking and conducts a case study to enrich the safety net/cargo net paradigms. In this paper, household data in the YNL river region are used and a two-step clustering method is developed to classify these households into three types: hanging in (type I), stepping up (type II) and stepping out (type III). Then a multinomial logit model is adopted to identify determinants of households' livelihood choice. The results indicate that drought poses a significant negative impact on farmers' choice of type II, while household size, educational level of labor and medical expenditure have a significant positive impact on the choice of type II; spring frost, proportion of skilled training, borrowed money and the ratio of agricultural equipment have a significant positive impact on their choice of type III. Some anti-poverty policy implications are put forward in the last on the basis of these determinants.

## 1. Introduction

As a worldwide issue, poverty attracts great attention from scholars. A large quantity of research has addressed the causes and characteristics of poverty and many anti-poverty methods have been proposed from different perspectives (Fischer, 2018; Holmes, 2018). Developing advantageous endogenous livelihood transition and exogenous governmental policies are commonly recognized as the main routes to anti-poverty. But in a certain time, the livelihood transition can be regarded as livelihood choice for different households. The livelihood choice, which means different adoptions of occupation or industry that local residents depend on for subsistence, often includes livelihood diversification (Krantz, 2001), participation in market for farmers (Guo and Zhu, 2009), labor migration for non-farm employment (Luo, 2010) and so on. As for the exogenous governmental policy route, many studies have explored the relationship between governmental policies and poverty alleviation, and held that appropriate governmental policies promote the realization of poverty reduction. For example, widening migration channels (Du et al., 2005; Nong and Luo, 2010), innovating

the alleviation policy system, increasing investment in infrastructure, and updating the traditional economic structure and the traditional concept (Liu et al., 2009) under the assistance of government are considered as necessary to solve the urgent knotty poverty issue. How to seek exogenous governmental policies to achieve advantageous endogenous livelihood choice is highly important for anti-poverty. In general, the exogenous governmental policies can be divided into two types: safety net and cargo net (Barrett, 2010; Oluch-kosura and Marenja, 2004). Safety net means a series of protective measures being taken to prevent households from slipping into poverty by discouraging the factors that facilitate downward household movement (Katikireddi and Higgins, 2015; Koninck and McGee, 2001). For example, due to the exposure to climate changes and severe diseases, some families without a reliable and perfect safety net would fall into poverty (Gentle and Maraseni, 2012; Smit and Wandel, 2006). Although some regions have developed safety nets, their effect on poverty alleviation is weakened because of untargeted identification or inaccurate pertinence (Felland et al., 2009; Sumarto et al., 2005). On the other hand, cargo net usually indicates measures that can lift people out of poverty. Well-crafted

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<https://doi.org/10.1016/j.ecolind.2019.02.007>

Received 1 August 2018; Received in revised form 21 January 2019; Accepted 8 February 2019

Available online 16 February 2019

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cargo nets are designed to catalyze the exit from poverty. How to identify key factors to lift people out of poverty becomes particularly important (Oluch-kosura and Marennya, 2004). There exist some essential distinctions between safety net and cargo net. The former focuses on protecting the poor and preventing further plunge into a more terrible state while the latter provides these people with methods or power to escape from poverty. To our knowledge, although there are some theoretical safety net/cargo net paradigms, case studies on specific safety nets and cargo nets for anti-poverty are still called for.

The Tibetan Plateau, characterized by high altitude and harsh climate, has nearly 40 state-level poverty-stricken counties and keeps a high incidence of poverty (Ren and Li, 2010; Shen, 2015) up to 23.7%. The livelihood assets of local people are fragile and interact as both cause and effect (Li and Mao, 2012). Besides, people there have a closed social network and show homogeneity in capital, which result in the weak mobility of the poor and the fixed situation of economic poverty (Liao and Li, 2009). In order to speed up the development and promote common prosperity of the Tibetan Plateau, the government has put forward relevant policies to help the poor for decades. However, these policies have been implemented in a large and extensive form, reducing the pertinence of poverty alleviation (Ge and Xing, 2015). The existing studies find a certain contradiction between the poverty alleviation policies and the local farmers' needs. This could be attributed to the fact that the government fails to incorporate the actual situation of farmers and herdsmen in policy making, so the effect of poverty alleviation policies will be weakened and the goal of poverty alleviation be missed (Hua et al., 2013; Qiu, 2016; Yan and Zhang, 2011).

For illustration, although the central government has implemented preferential financial policies in the Tibetan Plateau for a long time, the types of loans and the credit structure have not changed. These loans only include supply and marketing cooperative loan, poverty reduction loan, short-term agricultural loan, township enterprise loan and commercial household loan, which are often invested in a single way lacking originality. At the same time, these loans are often only provided to traditional small households consisting of farmers and herdsmen, while industrial structure adjustment and diversified economy engaged by farmers and herdsmen are rarely permitted to apply for it. As a result, this credit policy fails to provide better livelihood choice for the local people. Subsequently, targeted poverty alleviation policies aimed at different population groups are expected (Wang and Zhu, 2013; Yan and Zhang, 2011; Han and Liu, 2017). Finding out the factors that restrict anti-poverty and affect livelihood choice is helpful in putting forward safety net policies and cargo net policies for different population groups. Therefore, studying the livelihood choice of different types of farmers and locating the factors that affect their livelihood choice are the key to seeking targeted poverty alleviation policies.

The headwater area of the YarlungZangbo River, the Nyangqu River and the Lhasa River is a region with good natural conditions, a long history and high level of social and economic development in the Tibetan Plateau. However, poor agricultural infrastructure and fragile agricultural ecology, together with biophysical, harsh climate and social factors, make the farmers and herdsmen in this region live in long-term poverty. This paper aims to identify determinants of livelihood choice of farmers and herdsmen in the YNL river region in the TAR and then to provide some enlightenment about the anti-poverty policy formulation. Firstly, farmers and herdsmen in the YLN river region will be divided into hanging in type (type I), stepping up type (type II) and stepping out type (type III) via a cluster analysis method, according to the definition and classification standard of Dorward (Dorward, 2009; Dorward et al., 2009; Scoones et al., 2012). The meteorological disaster and different livelihood capital of sample households will be chosen as the explanatory variables. And then, factors influencing livelihood choice will be identified. Finally, some anti-poverty policy implications will be elaborated on the basis of these determinants.

## 2. Conceptual frameworks

The Sustainable Livelihood Analysis (SLA) established by the Department for International Development (DFID) regards farmers as making a living in a particular vulnerability background. Five major livelihood capitals (natural capital, human capital, financial capital, physical capital and social capital) are the core contents of the SLA. Sustainable livelihood analysis method is a standardized and systematic research method for the sustainable livelihood of poor peasant households, which bases on sorting out and analyzing the livelihood of farm households. At present, many scholars have finished a lot of research on many aspects of farmers' livelihood by using the method of SLA, such as livelihood diversity (Smith et al., 2001), livelihood vulnerability (Hahn et al., 2009), livelihood security (Singh and Hiremath, 2010), livelihood and poverty alleviation (Ellis and Bahigwa, 2003), energy consumption and livelihood (Cherni and Hill, 2009), land use and livelihood of farmers (Soini, 2005).

In this paper, we concentrate on livelihood and poverty alleviation. It is widely believed that poverty is rooted in the following factors: 1) Environmental factors: unfavorable natural environment, scarce resources, complex terrain, severe meteorological disaster, poor location and sharp decline in non-renewable resources (Jalan and Ravallion, 2002; Yang et al., 2006; Liu et al., 2008; Glauben et al., 2012); 2) Economic factors: slow economic development, large fiscal deficits and unstable income (Jalan and Ravallion, 2000; Klasen et al., 2016; Guo and Zhu, 2009); 3) Educational factors: inadequate education, poor teaching quality and low labor quality (Knight and Li, 2009); 4) Cultural factors: outdated idea of agricultural production and unenlightened cultural education (Yang and Zhang, 2004); 5) Institutional factors: incomplete systems, deviated policies and inflexible institutional mechanisms (Li et al., 2016). It is also found that poor families are generally accompanied by a heavy burden, poor labor quality, narrow employment opportunities, low income, lagging consumption level and low production efficiency (Gao and Wen, 2004). All these factors contribute to poverty to a certain extent, and the factors causing poverty vary from place to place.

Livelihood transition, as a means of anti-poverty, refers to a process of fundamental changes in occupation or industry that local residents depend on for subsistence or livelihood. But in a certain time, the livelihood transition can be viewed as livelihood choice for different households. In the process of livelihood choice, there exist different influencing factors. Finding out the factors that affect the choice of different types of farmers is helpful in putting forward reasonable and precise policy recommendations for livelihood transition. In line with the existing studies, there are several factors which may affect livelihood choice of farmers and herdsmen (e.g., household size, medical expenditure, participation in rural cooperatives, cropland area, and proportion of agricultural equipment) (Thongmanivong and Fujita, 2006; Radel et al., 2010).

Specifically speaking, climate disaster has a great impact on farmers and herdsmen's livelihood, which exacerbates the vulnerability of agriculture and animal husbandry. If extreme high temperature events occur frequently, the frequency of drought will increase and lead to serious agriculture and animal husbandry loss. Besides, high temperatures not only increase the range and intensity of crop pests and diseases (Han et al., 2011; Abayawickrama et al., 2017), but also shorten the grain filling stage and reduce the cold-resistance ability of crops (Ren et al., 2010), resulting in a decrease in crop yield (Yang et al., 2013), which have a negative impact on the livelihoods of local farmers and herdsmen. Household size can be an important factor affecting livelihood choice. Family members, as labor force, will participate in agricultural activities. A large household size can provide a surplus of labor to engage in diversified non-agricultural activities. These non-agricultural activities can help families to bring more income to meet the needs of their lives. In addition, medical expenditure is a vital factor affecting livelihood choice. Medical expenditure reflects the health

status of family members, and the health level of family members is directly related to labor productivity. On the one hand, a lot of medical expenditure indicates that the economic burden is heavy and un-conducive to the development of the family; on the other hand, the productive rate of unhealthy members is lower than that of healthy members, thus affecting the family income. Participation in rural co-operatives may be a major factor affecting livelihood choice. In recent years, many rural cooperatives have been set up in the study area to provide farmers with agricultural and technical opportunities and market to lead and guide farmers to grow economic crops so as to improve their income. Cropland area is an additional factor that may lead to livelihood choice. The larger the cultivated area is, the more crops the family can grow. And there is a good chance of harvest, which offers a basis for the accumulation of family capital. Proportion of agricultural equipment is also a significant factor affecting livelihood choice. Farmers with a high proportion of agricultural equipment enjoy high efficiency in agricultural activities, thereby reducing the production time of agricultural activities and making it possible for labor force to engage in non-agricultural activities (Wang et al., 2014; Zhang et al., 2017).

Despite the fact that our study area was different from those mentioned in the existing studies, the related factors could still be used for reference. In the YNL river region, the livelihood choice of farmers and herdsman might not only be related to the above factors, but also be related to the locally specific factors (such as the income from the sale of *Cordyceps*, government subsidies, loans and so on). Therefore, this paper proceeded from these factors to investigate the factors that affect the livelihood choice in the YNL river region.

### 3. Study area and data sources

#### 3.1. Study area

The YNL river region in the TAR generally includes the middle watershed of the YarlungZangbo River, the Nyangqu River and the Lhasa River. It starts from Zangri county in the east to Lhatse county in the west, and from the plateau lake basin area in the northern Himalayas in the south to the Gang Tizi–Nyainqentanglha Mountains in the north (87°00′–92°35′E, 28°20′–31°20′N). The altitude ranges between 2700 and 4200 m. The region covers an area of  $6.57 \times 10^4 \text{ km}^2$ , accounting for 5.47% of the total land area in the TAR. The climate in this region is mild and the annual average temperature is between 4.7 and 8.3 °C, with the extreme maximum temperature ranging between 26.5 and 29.4 °C while the extreme minimum temperature between –25.1 and –16.5 °C. Besides, the annual total radiation is between 7.6 and 8.0 MJ/m<sup>2</sup>, the annual sunshine hours are between 2400 and 3000 h, and the annual rainfall is between 270 and 550 mm. The annual frost-free period reaches about 150 d. Rain and heat occur in the same period. However, from 1971 to 2011, the warming rate was 0.039 °C per annum, significantly higher than that of other areas in China with the most obvious period of warming being in winter. Precipitation in the Tibetan Plateau has increased significantly since 1986, and fluctuated with a variation rate of 0.67 mm per annum. In addition, the frequency of extreme high-temperature events (hot days, hot nights, and successive warm periods) increased, while the frequency of extreme low-temperature events (cold days, cold nights, continuous cold periods, frost days, and freezing days) decreased.

The YNL river region consists of Lhasa, Shannan and Shigatse prefectures, covering 18 counties with developed agriculture and a long history of a farming economy and culture. It is the political, economic, culture and transportation center of the TAR. In this region, there are a variety of geomorphological conditions, complex terrain units and severe meteorological disaster, such as mountainous plateaus and valley plains and drought, which directly or indirectly affect farmers' livelihood. Traditionally, households in this region are comprised of farmers and herdsman who derive their majority of income from agricultural

and breeding activities such as cropping and livestock husbandry. Since the 1980s, the labor force in this region has gradually transferred to the secondary and tertiary industries, prompting the livelihood diversification of farmers and herdsman. Nonetheless, several factors hinder livelihood improvement here, including high altitude, harsh climate, lack of water, remote areas and traffic inconvenience, leading to a serious poverty problem (Hua et al., 2013). The valley in this area is broad and flat, with thick soil layers and fertile soil; water diversion irrigation can be conducted here, and the cropland is centralized and contiguous. The crops mainly include highland barley, wheat and rapeseed. Livestock include yaks, yak-cow hybrids, cows, horses and sheep. According to the 2015 *Tibet Statistic Yearbook*, the cropland in the area reached  $16.061 \times 10^4 \text{ hm}^2$ , accounting for 67.83% of the total cropland area in the TAR. The sown area reached  $15.89 \times 10^4 \text{ hm}^2$ , accounting for 62.86% of the total cropland area in the TAR. The agriculture output value was  $74.92 \times 10^2$  million yuan (RMB), accounting for 50.124% of the total agricultural output in the TAR. The grain output was  $72.02 \times 10^4$  tons, accounting for 71.56% of TAR's grain production. According to the statistics, there were 298 thousand farmers and herdsman whose per capita net income was less than 2300 yuan, accounting for 48.98% of the total low income population in pastoral area in the Tibetan Plateau. The YNL river region is not only the core area but also the poverty epitome of this concentrated area. Therefore, this paper selected the YNL river region as the study area, which was of great significance to the development of the Tibetan Plateau.

#### 3.2. Data sources

This paper mainly used data from a survey conducted from July to August in 2015 in the YNL river region. A pre-test for 7 days in July was conducted, and then the questionnaire was modified according to the feedback from interviewees. The paper adopted stratified sampling and random sampling methods during the investigations. To be specific, stratified sampling was used for the selection of sample counties and villages and random sampling was used for the selection of sample households. Firstly, the main leaders of the local agriculture and animal husbandry bureaus were interviewed. Sample counties were then chosen from all counties in the YNL river region, considering the local socio-economic development, transportation and accessibility, resource and agricultural conditions. As a result, 9 counties were chosen as the sample counties. Secondly, sample villages and households were selected. A semi-structural interview was adopted in sample household investigation to obtain questionnaires. On the basis of presupposed interview topics and pre-formulated outlines, this method opens up questions to the interviewees, and they would answer questions or express their opinions according to past events. And it has a great flexibility. At first, a seminar with village leaders and other representatives in charge of the village was held to fully understand the main situations of the village, including overall poverty, natural disasters, changes in cultivated land area, crop planting and livestock breeding, and distance from their residences to the town. Next, 2 villages were selected from each county and totally 18 villages were selected. Approximately 10 sample households were selected from each village. In the interview process, we did not choose which families to interview for a special purpose. But in a village, some families are willing to accept interviews but some are not. These families who are unwilling to be interviewed because they were working and did not have free time for interviews, or the householder was not at home and other family members could not fully answer our questions. In order to improve the quality of the questionnaire and overcome the barriers to the communication with local farmers, 3 Tibetan students were employed as interpreters and received standard training before the investigation. In the interview, the householders were mainly interviewed, because the householder knew more about his family, such as the crops and livestock. When there were some questions that the

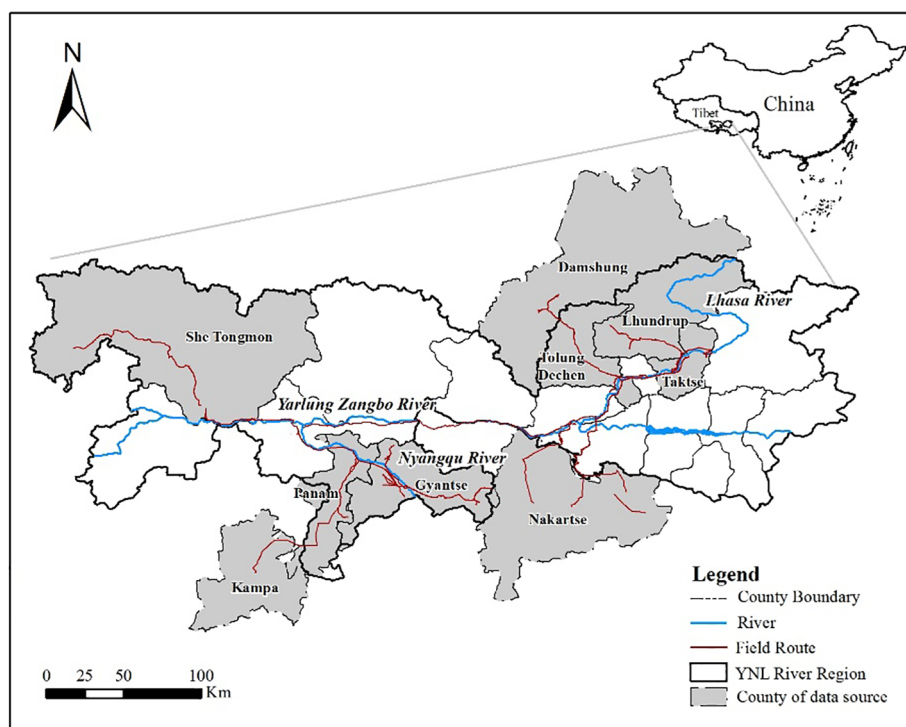


Fig. 1. Study area and field route.

householder did not know, such as all kinds of subsidies, his wife or other family members who knew the actual situation would provide some supplementary and extra information to us. The survey time for each household was about 1–2 h. Finally, 188 valid questionnaires in 18 villages from 9 sample counties were obtained after removing invalid ones. The field investigation route was shown in Fig. 1. The questionnaire content mainly covered: household information, livelihood strategy and livelihood assets, including human capital (i.e., household size and educational level), natural capital (i.e., the area of cropland), physical capital (i.e., the proportion of agricultural equipment), financial capital (i.e., government subsidies and medical expenditure) and social capital (i.e., distance from residence to town and the number of village cadres).

## 4. Methods

### 4.1. The selection of variables

#### 4.1.1. Dependent variables

According to the definition and classification of Dorward (Dorward, 2009; Dorward et al., 2009; Scoones et al., 2012), three broad types of livelihood strategies were identified. On the basis of their description, several relevant indicators were selected and then a two-step clustering method was used to classify the households in the study area. According

to the relevant definition and considering the actual situation, this paper selected seven indicators to characterize the types of households. Details were shown in Table 1.

A two-step clustering method was chosen to secure the classification results of households. The first step was pre-clustering, that is, the households were first classified. The pre-clustering was the optimal grouping of all samples and the optimal results were up to three groups. The second step was formal clustering, which meant re-clustering based on the result of the first step and determined the final clustering results. The results were shown in Table 2. As the proportion of type I was 28.72% and close to the incidence of poverty in the TAR (23.70%), it was believed that the results of this clustering were reliable. The households were divided into three categories: hanging in type (type I), stepping up type (type II) and stepping out type (type III). Then the types of households were used as the dependent variables.

**Type I:** It meant that the existing agricultural activities could only maintain their basic life, mainly including agriculture and animal husbandry. This kind of households often faced adverse socio-economic circumstances.

**Type II:** This kind of households expanded their activities with some additional investments in order to increase production and income to improve livelihoods (an example might be the accumulation of productive dairy livestock).

**Type III:** This kind of households accumulated their assets through

Table 1  
Description of cluster variables.

Variable	Description
Proportion of non-agricultural population	The number of people engaged in non-agricultural activities/The number of household labor
Proportion of non-agricultural income	Non-agricultural income/Total income
Proportion of agricultural income	Agricultural income/Total income
Increased proportion of reclamation	Area of newly reclaimed land/The original land area
Increased proportion of the number of livestock	The number of increased livestock/The original number of livestock
Increased proportion of breeding investment	The increased breeding investment/The original breeding investment
Increased proportion of planting investment	The increased planting investment/The original planting investment

Note: The standard for farmers' livelihood activities was mainly obtained through the questionnaire.



**Table 2**  
Clustering results.

Variable	Type I (54, 28.72%)	Type II (53, 28.19%)	Type III (81, 43.09%)
Proportion of non-agricultural population	0.03	0.27	0.37
Proportion of non-agricultural income	0.02	0.61	0.63
Proportion of agricultural income	0.42	0.24	0.16
Increased proportion of reclamation	0.06	0.03	0.08
Increased proportion of the number of livestock	1.56	2.23	0.11
Increased proportion of breeding income	1.62	2.50	0.11
Increased proportion of planting income	1.10	2.03	0.41

existing activities so that they could provide a base or ‘launch pad’ for engaging in different activities with initial investment requirements which led to higher and/or more stable returns. They often financed children’s education, purchased vehicles or buildings and were engaged in several non-farm activities.

#### 4.1.2. Independent variables

Based on the sustainable livelihood framework and our conceptual framework, and in line with the farmers’ livelihood level in the YLN river region, independent variables were selected (Table 3).

#### 4.2. The selection of econometric model

As the dependent variables in this paper were discrete and multi selection variables (i.e., type I = 1, type II = 2, type III = 3) which were mutually exclusive, a multinomial logit model (Mlogit model) was adopted. The establishment of Mlogit model required a reference and thus type II was chosen. And then type II would be compared with other types in this paper to find out what factors can affect the choice of livelihood. The Mlogit model of household types was expressed as follows:

$$\text{logit}(y) = \ln \left[ \frac{P(y = k)}{P(y = 1)} \right] = a_k + \sum_{n=1}^N \beta_{kn} x_n \quad (1)$$

In formula (1),  $K$  was the household type;  $x_n$  was the factor influencing the household type;  $a_k$  was the constant;  $\beta_{kn}$  was the estimated coefficient value corresponding to the  $n$  influencing factor of the  $K$  family.

STATA 12.0 was used for measurement and statistical analysis. For the purpose of ensuring the reliability and robustness of model results, Robust was employed to correct the estimated results. At the same time, given the differences in economic level and geographical position between different regions, which could be reflected by different villages and suggest the possibility of spatial autocorrelation, clustering was used to solve the spatial autocorrelation.

Besides, Pearson correlation coefficient (PCC), tolerance (Tolerance) and variance inflation factor (VIF) were adopted to test the results. The results showed that the PCC between *cropland area* and *medical expenditure* was the highest, reaching 0.712 ( $0.712 < 0.8$ ); the tolerance of *cropland area* was the lowest as 0.394 ( $0.394 > 0.1$ ) while its VIF was the highest as 2.54 ( $2.54 < 10$ ). Based on the above results, there was no multicollinearity among independent variables. In other words, the analysis results of the model would not be affected.

## 5. Results

### 5.1. Characteristics of households in the study area

According to the statistics of the questionnaires, some differences between sample households were noted (Table 4). Most farmers and herdsmen had similar perceptions of local climate change. The three types of households all found drought and frost increasing, and flood decreasing. Type II believed that spring frost has reduced slightly. The household size of the three types increased from type I to type III, while

the dependency ratio decreased in turn. Type I households had less labor force while type III households had more labor force. Insufficient labor force cannot provide income protection for families. As for the educational level of labor force, type II and type III had little difference, but that of type I was low. Usually, labor force with lower educational level lacks the ability to accept new knowledge and can hardly work in a high-income industry. Besides, there was little difference in government subsidies between the three types of farmers. As for the distance from residence to town, type III was closer to the town, thereby in favor of family labor’s engagement in non-agricultural activities. In terms of cropland area, there was not much difference between the three types of families. Concerning the proportion of agricultural equipment, type III households had the highest proportion (0.162), which improved farm efficiency and saved more labor and time to engage in other production activities.

### 5.2. Econometric results

#### 5.2.1. Factors influencing farmers’ livelihood choice between type II and type I

Drought posed a significant negative impact on the choice of type II. When farmers and herdsmen perceived droughts to be increasing, they would reduce crop cultivation, which was not conducive to the accumulation of family capital. Consequently, it was difficult for these farmers and herdsmen to choose a better livelihood choice, and they would remain in poverty.

Household size imposed a significant positive effect on the choice of type II. The larger the family size was, the more the quantity of labor force and the greater the possibility of capital accumulation for family would be. A small household size might lead to labor shortage, so that small households could not engage in more livelihood activities or accumulate capital. Thus, there was a great possibility of those families falling into poverty.

Educational level of labor force displayed a significant positive impact on the choice of type II. In developing countries, poverty was always linked to a low educational level (Filmer, 2000). Hossain (1996) reported that the poorest households in China spent 14.2% of annual income on education, while the wealthiest ones spent only 5.5%. In addition, parents with low educational level were not good at their children’s study (i.e., helping the kids with their homework). Besides, the lack of community resources in poor areas often led to low education quality of school, which would decrease education return and hinder the entrance into school. With the rapid development of science and technology and frequent changes in production processes, the demand for the educational level on workers was becoming increasingly higher. Therefore, the higher the educational level of labor force was, the greater the possibility of engaging in non-agricultural income-generating activities would be. Compared with agricultural activities marked with large investment, long duration and more physical energy consumption, the labor force with a higher educational level tended to engage in more luxurious and well-paid non-agricultural activities.

Medical expenditure imposed a positive yet insignificant impact on the choice of type II as well. According to the statistical results, the average medical expenditure of type I and type II families was 1970.370

**Table 3**  
Characteristics of variables (N = 188).

Type	Variable	Description	Mean	Standard deviation	Min.	Max.
Dependent Variable Climate Indicator	Household type	type I = 1, type II = 2, type III = 3	1.86	0.84	1.00	3.00
	Drought	Decrease = 1, no change = 2, increase = 3	2.89	0.43	1.00	3.00
	Waterlog	Decrease = 1, no change = 2, increase = 3	1.73	0.86	1.00	3.00
	Spring frost	Decrease = 1, no change = 2, increase = 3	2.30	0.81	1.00	3.00
Human Capital	Household size	Number of family members (persons)	6.03	2.12	1.00	14.00
	Age of householder	Age of household head (years)	51.10	11.13	23.00	81.00
	Educational level of labor force	Illiterate = 1, primary school = 2, middle school = 3, high school = 4, college and above = 5	1.89	0.49	0.00	3.33
Financial Capital	Proportion of skill training	The ration of the number of skill training labor force to the total number of family labor	0.09	0.14	0.00	1.00
	Government subsidies	Single child subsidies, social security subsidies, government subsidies for the elderly (yuan)	3849.96	5938.90	0.00	71583.20
	Proportion of income from gathering <i>Cordyceps</i> fungi	The ratio of the income from gathering <i>Cordyceps</i> fungi to the total family income (%)	0.03	0.10	0.00	0.59
	Borrowed money	Whether the household borrowed money from others (yes = 1; no = 0)	0.69	0.47	0.00	1.00
	Medical expenditure	Family members' disease costs in household (yuan)	5634.04	24620.65	0.00	280000.00
Social Capital	Distance from residence to town	The distance between the farmer's residence and the nearest town (km)	42.89	42.70	0.00	170.00
	Cropland area	Cropland area that the household owned (mu)	10.54	8.25	0.00	45.40
Natural Capital	The number of cropland	The number of cultivated land in a family	9.59	8.06	1.00	51.00
	The proportion of agricultural equipment	The ratio of agricultural equipment that the household owned to the all kinds of equipment (12 in total) (%)	0.96	0.19	0.00	1.00

yuan RMB and 11338.680 yuan RMB, respectively. Based on the field survey, type I had low family income and heavy burden. So when family members were sick, they were unable to bear medical expenses, but only bought the cheapest drug for temporary treatment. As regards type II, their family income was higher than that of type I, so relatively more money could be used for disease treatment. And according to the results of independent T test, there existed no significant relationship between the two types. Given that medical expenditure was a core element in expenditure, the occurrence of poverty caused by illness directly affected the poverty reduction policies. These families increased medical expenditure due to illness, which might reduce the savings, increase debt and make asset accumulation more difficult. This situation often resulted in families with good life condition sticking into poverty caused by illness. At this point, the rescue policy should be focused on medical assistance rather than living aid.

### 5.2.2. Factors influencing farmers' livelihood choice between type II and type III

*Spring frost* had a significant positive impact on the choice of type III. The spring frost not only had effect on crop cultivation, but also reduced the forage output for livestock, indicating that farmers and herdsmen would not raise too many livestock. On the basis of the existing economy and capital accumulation, type II families could not further increase the investment in agriculture and animal husbandry production. Thus, they were very likely to engage in non-agricultural activities to make up for the agricultural losses caused by frost, which would facilitate them to choose "stepping out" livelihood.

*The proportion of skill training* showed a significant positive impact on the livelihood choice of type III. The higher the proportion of skill training for family labor, the easier the livelihood choice of type III. If the family labor force was trained with more professional skills, the possibility of participating in non-agricultural activities would increase. Compared with agricultural activities marked with large labor input, long duration and more energy consumption, they tended to engage in more relaxed and well-paid non-agricultural activities. Therefore, high training proportion was likely to promote the advantageous choice of farmers and herdsmen's livelihoods.

*Borrowed money* showed a significant positive effect on the choice of type III. Borrowing more money would provide a basis for farmers to engage in other livelihood activities. Although there was a certain risk of borrowing money and it needed to be repaid in time, the households of type II could invest in existing livelihood activities and then gain a considerable return, which would contribute to "stepping out" livelihood.

*Proportion of agricultural equipment* exerted a significant positive effect on the choice of type III. This could be explained by the fact that households with a higher proportion of agricultural equipment were more efficient at agricultural activities. Compared to families with a lower proportion of agricultural equipment, those families with a higher proportion required less labor when dealing with the same amount of agricultural activities. Therefore, the extra labor force could engage in more diversified non-agricultural activities, which were beneficial to the choice of type III (Table 5).

## 6. Discussions

Drought has some adverse effects on agricultural activities of farmers and herdsmen, which may further aggravate the poverty situation of local people. This is similar to the results of [Heltberg et al. \(2014\)](#), who believed that 50% of the poor people were more likely to suffer adverse effects during drought. In addition, some scholars believed that other climate shocks, such as heat waves, heavy rain, and so on, would make the poor suffer more losses, and it was also very difficult for them to receive post-shock support from friends and financial system as well as social safety nets ([Winsemius et al., 2015](#); [Park et al., 2015](#)). Climate-related shocks can keep people remaining in poverty by

**Table 4**  
Basic characteristics of households.

Type	Variable	Type I	Type II	Type III
Climate indicator	Drought	2.926	2.830	2.901
	Waterlog	1.667	1.623	1.840
	Spring frost	2.148	1.943	2.630
Human Capital	Household size	5.241	6.321	6.358
	Educational level of labor force	1.667	2.008	1.952
	Proportion of skill training	0.040	0.093	0.116
Financial Capital	Government subsidies (yuan)	3661.344	3975.046	3893.863
	Medical expenditure (yuan)	1970.370	11338.680	4343.827
Social Capital	Distance from residence to town (km)	43.037	48.566	39.074
Natural Capital	Cropland area (mu)	9.222	8.635	10.474
Physical Capital	The proportion of agricultural equipment	0.116	0.107	0.162

**Table 5**  
Factors influencing the livelihood choice of households.

Variable	Between type II and type I		Between type II and type III	
	Coefficient	Std.	Coefficient	Std.
Drought	0.542 <sup>*</sup>	0.308	−0.220	0.550
Waterlog	0.014	0.316	0.047	0.334
Spring frost	0.126	0.273	1.800 <sup>***</sup>	0.484
Household Size	−0.365 <sup>**</sup>	0.146	−0.026	0.109
Age of Householder	0.011	0.021	−0.013	0.020
Educational Level of Labor Force	−1.944 <sup>***</sup>	0.616	−0.236	0.512
Proportion of skill training	−3.799	3.352	3.599 <sup>***</sup>	1.388
Government Subsidies	0.021	0.193	−0.239	0.178
Proportion of Income from Gathering <i>Cordyceps</i> Fungi	−0.040	0.089	−0.124	0.120
Borrowed Money	0.627	0.529	1.514 <sup>**</sup>	0.740
Medical Expenditure	−0.155 <sup>**</sup>	0.075	0.001	0.067
Distance from Residence to Town	−0.005	0.004	−0.007	0.006
Cropland area	0.0197	0.041	−0.027	0.042
The number of cropland	0.005	0.036	0.036	0.045
The proportion of agricultural equipment	4.440	2.939	12.523 <sup>***</sup>	3.355
Constant Term	2.976	2.185	−2.827	2.487

Note: \*, \*\*, \*\*\* denoted the significant statistical level of 0.1, 0.05 and 0.01 respectively; () Values represented the Robust standard error.

making it more difficult for households to accumulate assets, or even by creating irreversible impacts on human capital.

The econometric results have shown that a household with a large size has a low possibility of sinking in poverty. This is similar with the results of Lewis (1954), Malthus et al. (1986) and Schultz (1961), who considered that farmers with a larger household could accumulate more family capital and would not get into poverty. However, our finding is different from the result of Cao et al. (2016), who held that the large size of household increased the probability of falling into poverty. The possible reason might be that their study area was the Liangshan Yi autonomous prefecture, where some households with large size needed to support many elderly parents and children who could not engage in any income-generating activities.

With respect to the role of the *educational level of labor force*, our finding is in line with the results of Lockheed et al. (1982), Li and Mao (2011) and Jamison (1984). Jamison (1984) studied the relationship between educational level of farmers and labor productivity in Nepal and found that a farmer with a formal education background for more than seven years could achieve a grain output growth of more than 30% and improve his/her income. However, there exist some differences between the study by Wedgwood and ours. He suggested that the influence of education on local poverty alleviation or income improvement was uncertain or not obvious. The reason might be that the

educational level in his study area was extremely low compared with that in our study, and thus many potential benefits failed to be achieved through low quality education (Wedgwood, 2005).

Concerning *medical expenditure*, more medical expenditure makes it harder for farmers and herders to adopt a better livelihood. This finding is similar to the result of Wilkes et al. (1998), who suggested that farmers with more medical expenditure were more likely to be poor. In a family, a higher medical expense means more sick members and losses of labor force. The loss of a healthy member in a household will reduce the probability of a family's participation in activities by 22.55% and the income by 9.53%.

In regard to *borrowed money*, a higher proportion of borrowed money is more conducive to the completion of choice. This is similar to the views of Jiang and Yan (2006), who believed that borrowed money could gather more funds in a relatively short period to expand production or increase productivity and output by developing production technology, and ultimately promote the continuous improvement of farmers' income. But this is contrary to the view of Morduch (2007), who contended that microfinance had long-term impact on poverty reduction. Kong et al. (2014) also claimed that private borrowing with low interest rates could only temporarily increase the farmers' income and had no significant effect on poverty reduction in the future. This is due to the fact that in their research, borrowed money was mainly used for meeting life needs rather than expanding reproduction.

## 7. Policy implications

The present empirical study is a case study on the safety net/cargo net paradigms. As has been depicted above, although the government has promulgated some policies, it failed to consider the heterogeneity of different farmer and herdsman groups, causing contradictions between policy implementation and livelihood activities of farmers and herdsman and weakening the effect of policy implementation. On the basis of the foregoing discussions, some implications are proposed here to provide references for the implementation of targeted poverty alleviation policies. According to the previous statement, safety net policy is to provide basic living security for farmers and herdsman who have basic life problems, the core of which is to ensure that the lives of such farmers and herdsman are guaranteed. In other words, safety net policy is a kind of blood-transfusion poverty alleviation policy. From the results of this paper, we can see that the policies involved in type I households can be summarized into the category of safety net policy. That is to say, policies related to natural disasters, education and disease policies belong to the safety net. Cargo net can provide unexpected help to the families with certain wealth accumulation to get rid of poverty, in other words, cargo net policy is a kind of blood-generation poverty alleviation policy. The policies involved in type III can be basically summed up into the cargo net policy. Therefore, policies related to loans and agricultural equipment belong to cargo net. The policy implications discussed below are based on the most needed help for different families, or the constraints faced by different families in lifting themselves out of poverty, rather than providing the same help to all families. The policy of

safety net and cargo net can effectively solve the restrictions of these families to achieve poverty alleviation, which not only saves the financial expenditure of the state, but also realizes poverty alleviation goal.

In order to reduce the economic losses caused by natural disasters, China has implemented policies concerning agricultural insurance. However, the insurance premium rate is high, and it is difficult for type I families to bear the expenditure alone. At the same time, the large proportion of traditional agriculture, the low degree of agricultural economics of organization, the small support from the state, the narrow coverage and low level of insurance cause a lower insurance rate for farmers and herdsman, making them unable to enjoy a regular guarantee. Therefore, it is necessary to establish a cooperative insurance system, improve relevant legal systems, and safeguard mechanism so as to ensure sustained agricultural development and long-term rural stability. Besides, the regional disaster prevention and insurance mechanism should be established, and the meteorological monitoring system and the poverty monitoring system should be combined to enhance regional disaster prevention and reduction mechanism for the poor.

Education is highly important for the poor to get rid of poverty and increase their ability to make a living. Although the policy of “two exemptions and one subsidy (*liangmianyiibu*)” has been implemented, this policy is only for nine-year compulsory education. It is still a heavy burden for families that pursue a higher educational level, especially for type I households. Therefore, the government is supposed to put forward a way to pay full expenditure for education and training for poor families. If government finances are insufficient, the government can try to coordinate a certain proportion of financial funds to raise training costs and then provide individualized and customized education or training opportunities for the poor. At the same time, the government can make a full interest discount on financial funds and pay the loan principal after a certain period for the educated or trainees. In this way, the educational level and the ability to shake off poverty of the poor will be enhanced, which will exert a positive impact on promoting the overall poverty reduction.

In order to alleviate the “poverty caused by illness”, China has established a new rural cooperative medical system and a medical assistance system for serious diseases since 2003. However, because of the low level of cooperative medical care, the small scope of medical assistance and limited financial assistance, the rural medical security system lacks enough guarantees against the risk of serious disease suffered by the farmers and herdsman. Besides, the serious disease medical insurance issued at the end of 2012 in China is still in the pilot stage, and the beneficiary population is also limited. Compared with other types, type I has less family income, so a more suitable medical policy should be introduced. Firstly, accelerate the formulation of the compensation scheme for chronic diseases and expand the scope of the new rural cooperative medical system. Chronic diseases are characterized by a long course and a slow cure, thus increasing social and family financial burden. The current rural medical insurance system should appropriately incorporate some chronic diseases into the scope of compensation. Secondly, improve the medical assistance system and strengthen the linkage effect of the new rural cooperative medical system, medical assistance and other medical security projects. Thirdly, attention should be paid to the health care for specific groups of rural residents, such as the elderly and women. With the transition of China's social economy and the aggravating trend of aging population, the problem of health care for the elderly will become increasingly prominent.

In terms of type II families, most of them are not familiar with the application of financial funds, and not used to employ them to develop business. The demand for financial services is low and the willingness of loan is weak. Consequently, few farmers and herdsman can rely on financial loans to complete their better livelihood choice, so that they cannot get out of poverty smoothly. Therefore, the financial sector should encourage farmers and herdsman who have a certain economic base to apply for loans actively and design schemes that can complete livelihood choice by using loans for these families. For the farmers and herdsman who want to borrow money, the financial institutions can carry out mortgage free and guarantee free loans to them, thereby improving the status quo and helping type II families

realize a better livelihood choice.

Our research has shown that more agricultural machinery is beneficial to farmers' livelihood and poverty alleviation. The government should vigorously promote agricultural machinery suitable for highland areas, such as arable land machines and harvesters. At present, the government's subsidies are limited to micro-tillage machines, and the use of these machines is still not enough to provide the labor force from agriculture in the highland areas with more arable land per capita. Therefore, the government should continue to subsidize medium-sized farmland machines, or encourage the socialization of agricultural services, thereby freeing more workers from agriculture to the second and tertiary industries and promoting an excellent livelihood choice.

## 8. Conclusions

Although there are some theoretical studies on safety net and cargo net concerning anti-poverty policies, case studies on specific safety nets and cargo nets are rare. The existing research finds that in the Tibetan Plateau, there is a certain contradiction between the poverty alleviation policies and the local farmers' needs, so the effect of the poverty alleviation policies will be weakened and the goal of poverty alleviation will be missed. Therefore, the targeted poverty alleviation policies for different population groups are expected. This paper has provided a new method for proposing targeted anti-poverty policies through analyzing the livelihood choice of different types of farmers and identifying the factors that affect their livelihood choice. Based on our analysis of survey data in the YNL river region, the differences in the capital status of different types of farmers have been obvious. For type I and type II, the distinct differences have lain in human capital and financial capital; for type II and type III, the distinct differences have not only lain in human capital and financial capital but also in natural capital, social capital and physical capital. Accordingly, climate, human capital, financial capital and physical capital have exerted certain effects on farmers' livelihood choice. There have also been differences between factors influencing farmers' livelihood choice. Specifically, drought has posed a significant negative impact on farmers' choice of type II, while household size, educational level of labor and medical expenditure have had a significant positive impact on the choice of type II; spring frost, proportion of skilled training, borrowed money and the ratio of agricultural equipment have shown a significant positive impact on the choice of type III, suggesting that different types of households require different help. At last, targeted policy recommendations have been formulated.

## Acknowledgments

This work was supported by the National Natural Science Foundation of China (No. 41571093 and 41761144081) and the Strategic Priority Research Program of Chinese Academy of Sciences (No. XDA20040201). The authors appreciate the valuable comments of the anonymous reviewers.

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